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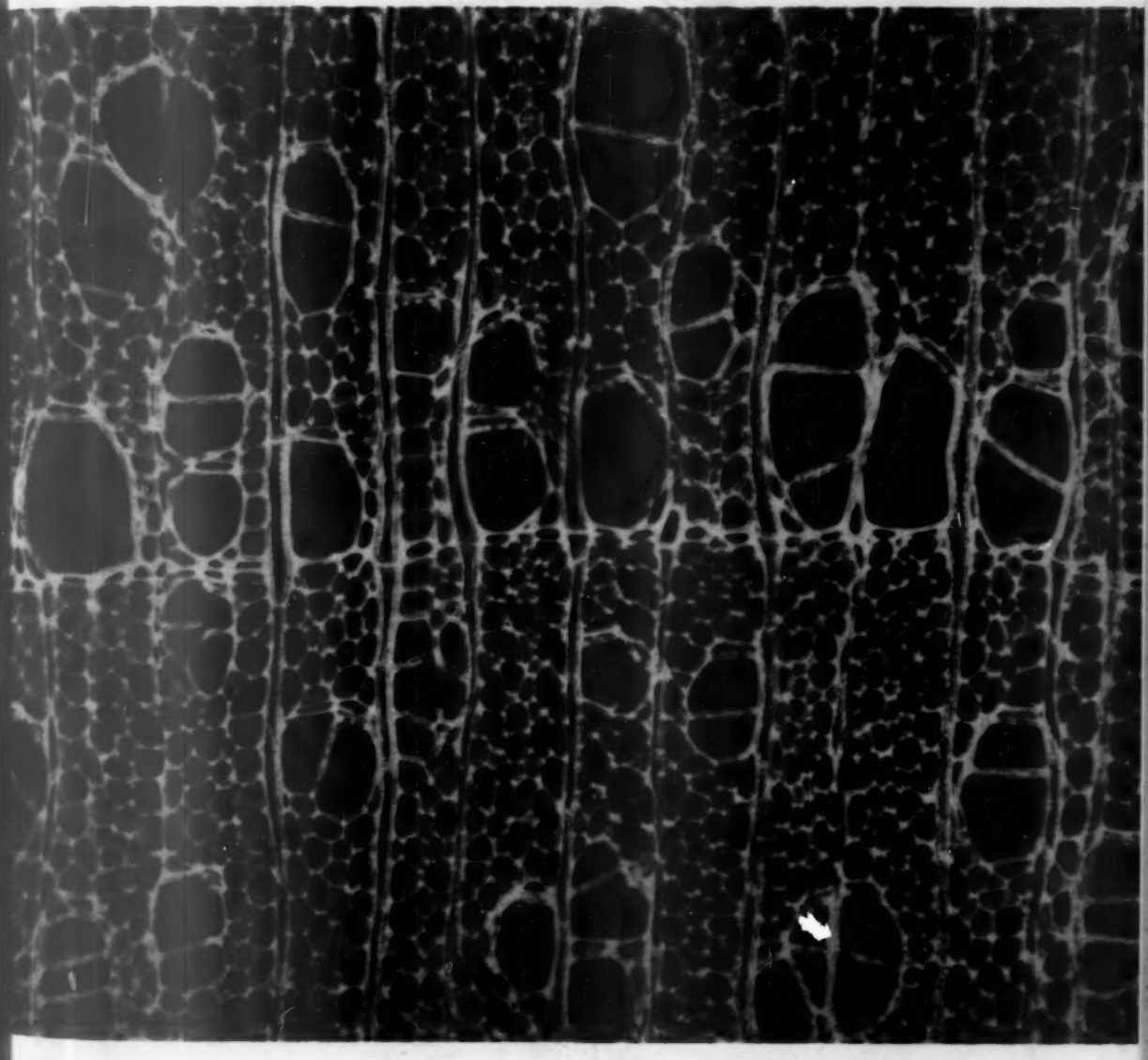

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The American Biology Teacher is a service publication of the National Association of Biology Teachers, teaching the life sciences from elementary grades through college.

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COVER PHOTO

Dr. Harvey Stork, Carleton College, is responsible for this beautiful photomicrograph of a section of birch wood.

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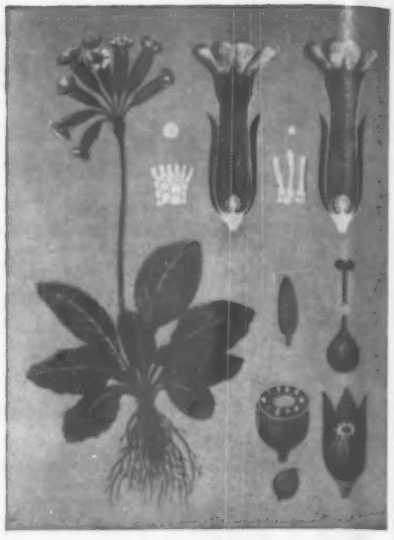

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THE BIOLOGIST IN THE PACKING INDUSTRY

HILMER C. NELSON, Wilson Branch, Chicago City Junior College

The biologist in industry is concerned primarily with solving the particular problems in which his company is interested. His findings will be used by his company to improve its products, produce new products, find new ways of utilizing its by-products, and improve its present processes. A considerable amount of routine work is usually included among the duties of the biologists, particularly those who are just entering the field. These may range from the performance of routine tests to the care of the large animal populations which are maintained by the research departments in the packing industry.

Employers of scientific personnel often prefer to train their own workers for the special tasks which they are required to perform. For this reason the training of the student who wishes to enter the industrial field should be as broad as possible. He should have adequate training in English to enable him to express himself clearly and concisely in the preparation of oral and written reports. For those who enter sales work public speaking is necessary, and for others it is highly recommended.

Nature of the Work. The biologists carry on toxicity experiments with small animals. Food samples, claimed by purchasers to have been toxic to man or animals, are returned to the food industry. These samples are then tested on small animal life to ascertain the legitimacy of the claims. Portions are fed to healthy animals for a period of time. The animals are then killed, and a careful examination is made of the internal organs to determine what toxic effects, if any, were produced. Small animal surgery, therefore, constitutes an important part of the work of these biologists. They should be able to distinguish between normal and pathological tissue.

Biologists also carry on assays of hormones, such as insulin, pituitary hormones, as well as a variety of other substances. They may carry on feeding experiments to determine the most desirable diets for domestic or experimental animals. Such projects provide an increased financial return to the producer as well as the packer, and provide more food and an improvement in the quality of the product for the consumer.

A large population of small animals is maintained by the research departments of the large food industries. These require care and attention. The meat packing industry is continually faced with the problem of finding new uses for their by-products. Biologists may play an important role in the solution of these problems.

Educational Requirements. There is a wide range in the preparation of workers in a large research laboratory. Correspondence with workers employed by the packing companies and conferences with research directors indicate that the following types of preparations are needed:

a. *High School Graduates.* These are needed to serve as laboratory assistants. They are employed in routine work, such as injecting animals with test materials, feeding animals, performing simple tests and serving as animal caretakers. As they increase in technical skill, they are advanced into the more highly technical positions. These workers are encouraged to enroll in evening classes in colleges and universities to increase their knowledge and skill.

b. *Junior College Graduates.* The large food industries have a definite need for workers who are graduates of junior colleges and have training in the following courses: general biology or zoology, comparative anatomy, bacteriology, botany, general chemistry, quantitative and qualitative analysis, advanced qualitative analysis, organic chemistry and biochemistry.

c. *College Graduates with the B.S. Degree.* One of the large packing companies employs 35 to 40 persons with the B.S. degree as general biologists. They are employed to test drugs on small animals to ascertain the effects, carry on toxicity experiments, biological assay work, developmental and control projects. These persons have majors in zoology and also have training in bacteriology and chemistry. The following courses may also be valuable to those in this category:

FIG. 1. Biologists in the research laboratory of a large packing company conducting a controlled experiment with white rats.

histology, haematology, histochemistry, microtechnique, and photomicrography.

d. *College Graduates with Advanced Degrees.* Pest control biologists are employed by many large industries. One packing company employs four entomologists who are trained as follows: one has a Ph.D. degree; two have the M.S. degree, and one has a B.S. degree. In each case the major training is in the field of entomology. These biologists test various types of chemical compounds as insecticides and determine their effects upon plants as well as animals. The development of insecticides as the means of controlling crop pests has expanded tremendously during the past decade. Many industries also employ entomologists to keep their properties free of insects, rodents and other pests as a part of their good housekeeping policy.

University trained biologists with the Ph.D. or M.S. degrees are commonly relied upon to develop methods for converting apparently useless by-products into useful products for which there is a demand, or for which a demand can be created. These men are well trained in chemistry as well as biology, and their productivity can greatly increase the financial returns of the company by whom they are employed.

Present Opportunities for Employment. In industry the biologist is often faced with the challenge to create his opportunities. There is a definite need in the packing industry for persons who are trained in general biology or zoology, comparative anatomy, bacteriology, biochemistry and pharmacology.

Occasionally, there is a need for persons trained for specific types of occupations. One research director reports that he had for some time looked in vain for a biologist trained in the following subjects: histology, haematology, histochemistry, microtechnique, and photomicrography. Finally he discovered a medical technologist who possessed the proper training for performing the tasks which were required.

The development of various types of fertilizers for farmers is undergoing rapid expansion. Biologists are needed for the detailed and painstaking work which is necessary in the testing and development of fertilizers best adapted for farm use, and for the lawns of home owners. Biologists who are trained in plant physiology have an important contribution to make in this field.

Salary Range. Salaries of biologists are dependent upon the value of their services to the industry which employs them. The data recorded below are merely suggestive and were obtained from one of the large meat packing companies in Chicago. They are as follows:

a. Biologists with two years of college training—$65 to $70 per week. (1) Technicians with two years of experience—$70 to $85 per week. (2) Senior Technicians with several years of experience—$85 and up per week. A technician may earn as much as $9,000 per year.

b. Biologists with the B.S. and advanced graduate degrees: (1) Junior Scientist in biology—$70 to $75 per week. (2) Scientist in biology—$75 to $90 per week. (3) Senior Scientist in biology—$90 and up per week.

The following data on salaries have been reported by various workers: a. Food technologist. Starting salary: $6,000. Maximum salary: $10,000. b. Bacteriologist. Starting salary: $3,600 for persons with the M.S. degree. Maximum salary: $8,000. c. Microbiologist and histologist. Starting salary: $4,000. Maximum salary: $10,000. d. Biological Chemist. Starting salary: $3,900. Maximum salary:

$6,500. e. Director of research. Starting salary: $3,600. Maximum salary: above $10,000.

Important Advantages in the Field. Although the food industry as a whole does not show as large a profit as do many other industries, and thus offers fewer financial inducements, it does offer many other advantages which are worthy of consideration by those biologists who may wish to enter the industrial field. These advantages are as follows: a. Advancement is unlimited for those who have the training and abilities required. b. There is ample opportunity for self-improvement. c. The large companies maintain retirement pension plans with income dependent upon years of service rendered the company by the employee. d. Sick leave is provided, the amount being dependent upon years of service. e. Workers are provided with paid vacations. f. Group insurance is provided for hospitalization. g. Life, accident and health insurance are provided for all employees. h. There is satisfaction in working with people who are interested in the same objectives. i. There is the stimulating influence of working with people of quality. j. There is much satisfaction in discovering new things or assisting in the discovery or development of new products or techniques. k. There are opportunities for improving operations and products. l. The work is of a stable nature, since meat is always needed. m. There is opportunity for the use of creative imagination. n. The acquired skill and experience can be used in other food industries. o. The industry offers security to those whose services render them acceptable to the company. p. There are no health hazards. q. There is a sufficient variety of research projects to render the work interesting.

Important Disadvantages in the Field. Perhaps the most serious disadvantage, in so far as the biologist is concerned, is the fact that he is pioneering in a relatively new field and must create his own opportunities, whereas the position of the chemist is much more securely established, due to a longer period of association with industry. However, some directors of research consider this to be an advantage because of the greater opportunities available for exploring areas which have not been previously investigated.

Workers in the industry have listed the following disadvantages: a. In some occupations within the industry the work tends to be monotonous. b. Salary increases are limited.

FIG. 2. Research workers studying small animals.

c. Considerable experience is needed within most organizations to advance. d. In some fields there is an insufficient amount of scientific procedure. e. The work may in some instances be very confining. f. The small margin of profit in the industry tends to limit activity in the research field. g. Inability of management to understand the problems of technology. h. High cost of materials; eighty per cent of overall cost is for animals. i. The financial rewards are not as great in the food industry as in other industries and occupations.

Other possible disadvantages to workers in the packing industry are: a. The curricula of most schools are of little practical value to workers in the field. b. Since in industry the value of one's services is dependent upon output per unit of time, employees often work under tensions of one sort or another.

Special Requirements. A great variety of skills and personality traits is demanded in the packing industry. A few of the most important may be listed: a. A high frustration threshold. Workers in the field must possess ability to cope with failures. b. Ability to set up controlled experiments and interpret data. c. Ability to reason and solve manufacturing problems. d. Capacity for organizing material. e. Patience. f. Ability to work with people. g. An open inquiring mind. h. Ability to express one's self in good English. i. Mental alertness. j. Better than average scholarship. k. Accuracy. l. Tenacity in staying with a problem until it is solved.

Although the number of biologists in the food industry is not large, the opportunities for workers trained in the field of biology are increasing as the latter demonstrate their value and effectiveness in the research departments of the packing industry. Particularly is this true when workers are trained in chemistry as well as biology.

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Employment Opportunities in the Biological Sciences. Supplement No. 17. Occupational Outlook Handbook. Washington 25, D. C.

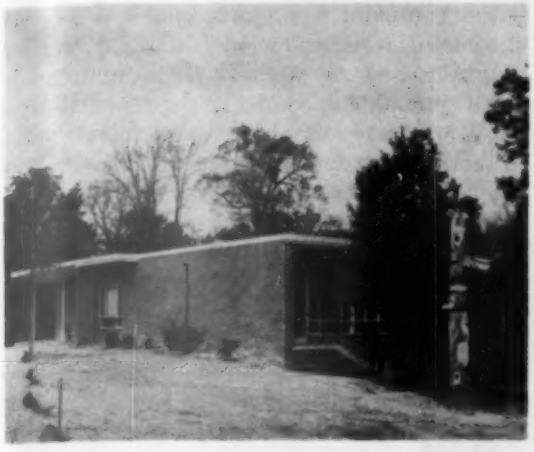
CAREER OPPORTUNITIES IN NATURAL SCIENCE EDUCATION

DOROTHY E. ALFKE, Pennsylvania State University, State College, Penna.

The author will present three additional articles on opportunities in natural science education; namely, lesser known opportunities, guidance of young women, and consideration of natural science courses in terms of students. Miss Alfke is engaged in the elementary and high school science education program in connection with her work at Pennsylvania State University. Last September she received the Ph.D. under E. Lawrence Palmer.

Most of us who are teaching biological sciences in the classrooms are happily aware that other agencies besides schools are contributing to the natural science education of our youngsters and of adults as well. These agencies include museums, botanical and zoological gardens, government conservation agencies, recreation and youth groups, and conservation minded groups such as Audubon Societies. Perhaps information about the educational positions related to natural science is the answer for some youngsters in our classes who ask what kind of jobs there are in biology, but are not suited for laboratory work and research.

The greatest number of the natural science educational positions are found in *museums*. These museums vary from small trailside nature museums to the large metropolitan ones whose natural history work is just a part of the total program. The writer estimates that about 100 museums employ from one to eight persons in such positions. One metropolitan museum employs one staff member for its natural science education program. Some of her time is spent with a science club whose members pursue investigations according to their interests. The members, under her supervision, publish a bulletin of their findings. She also serves other youth as well as adult groups by giving lectures and conducting field trips. A community nature museum employs two full-time staff members who prepare and maintain both live plants and animals. Some exhibits are done by specialists; some material is brought in by visitors. A program is planned to serve the children of the com-



Children's Nature Museum, Rock Hill, South Carolina. Courtesy: Natl. Foundation for Junior Museums, Inc.

munity, and it includes field trips, star gazes, and nature hobby activities at the museum. The staff members publish a museum paper, occasional natural science information bulletins, and some publicity material. Some metropolitan museums employ one or more persons to serve as guides for school groups. They work out the advance arrangements with classroom groups, greet the class on arrival and guide the group through a section of the museum in accordance with the planned purpose of the trip; they present films and other visual aids to groups to supplement the museum exhibits, and they may produce informational material for visiting groups to use in preparing for a visit and for follow-up after a visit.

Positions similar to some of the preceding are provided by the Massachusetts Audubon Society. About twelve persons are employed to conduct a *conservation education* program in cooperating school systems which contribute to the salaries of these workers. Most of the workers meet several periods a week with each of several upper elementary school classes throughout the year. They develop an understanding of natural history and conservation with these youngsters through lecture and discussion, using live and preserved plants and animals, films, and other visual aids. The Florida Audubon Society has recently started a program similar to that in Massachusetts, and other states have shown an interest in such a plan.

For a person primarily interested in *botanical sciences* there are opportunities for employment in school gardening programs and in some botanical gardens. In the latter some positions may involve guide and lecture work almost entirely. In other positions at botanical gardens, the worker spends most of his time with groups of youngsters or adults in a program of greenhouse or outdoor gardening. A few school systems conduct school gardening programs. Some maintain a garden center where one or more full time staff members are employed. Here classroom groups are brought for a series of gardening lessons and experiences. In other systems the staff member works with the youngsters in the classroom and continues the program through visits to home gardens developed by the children. The writer was able to obtain information about twenty individuals employed on a full time basis for horticultural education work. There are other part time positions in this category.

A few *zoological gardens* employ individuals to conduct an educational program. Some serve primarily as guides; some operate a question and answer booth; others prepare and present television and radio programs. Other duties include presenting lectures at the zoo or at schools, handling correspondence and preparing informational literature and publicity material. Caring for the animals or supervising their care is the responsibility of a few of the educational personnel. Sometimes a person employed for children's zoo may have the primary responsibility of insuring the safety of the visitors and the animals with a secondary function of education work. At present there seem to be about ten persons employed by zoological gardens for educational programs, but seventeen directors of zoos have stated that their future plans included the development of an educational program for which special personnel would be needed.

On a hike at Palomar Mt. Camp, San Diego County Schools.

A type of position fairly closely related to these already considered is that of school *camp counselor;* he has the opportunity to work with youngsters fortunate enough to spend up to two weeks of their time in a camp situation. The study of the camp environment and its relation to outdoor living, conservation, recreation, and history is an important part of the program. The number of school systems which operate school camps employing full time personnel shows a slow but steady increase. The camps are operated on the philosophy that the out-door environment offers opportunities for meaningful learning which is of great value in the education of youth and which cannot be achieved as effectively in the classroom. New concepts of citizenship and ecology are developed. Pupil growth in mathematics, communication skills, and health learning results from their functional application in camp. A school camp counselor is usually on 24-hour duty with the youngsters but is working with them in a new and challenging type of education. Most school camps seek persons with a teaching certificate in addition to specialized training in camping education or camping experience. In some camps all the counselors have had special training in natural science; in others, part of the staff possesses special qualifications in this area.

State and federal conservation agencies also offer opportunity for employment to individuals interested in educational work related to natural science and are showing concern over the lack of individuals adequately trained for such work. Educational personnel of these institutions work with school classes, summer camps, women's clubs, sportsmen's clubs, and other community organizations. Their responsibilities may include lecturing, writing magazine and newspaper articles or informational pamphlets, conducting field trips, helping interested groups plan and carry out study or action programs related to conservation, preparing films and other visual aids and presenting radio and television programs. The nature of each of these positions is usually determined in part by the training and abilities of the staff member and by the size and organization of the rest of the staff. The present trend toward an expansion of the public relations and interpretive work of conservation agencies indicates an increased demand from these sources for education workers.

Within each of the groups of positions discussed in this article, there is some variety of activity and responsibilities determined in part by the organization of the specific employing agency. But an even greater factor in determining the actual nature of a position often seems to be the individual doing the job. These positions have in common the fact that they are created by service agencies to help people appreciate, enjoy, and understand the natural environment. It is possible, therefore, for one to plan his training to qualify for several of these positions. A fundamental requirement is a broad but sound background in the natural sciences. This must include an ecological understanding of living things and a recognition of their place in the conservation education of the layman. The other broad phase of preparation for this type of work is that of methods of presentation. This requires an understanding of and fondness for people and the development of skills and techniques of interpretation.

ON UNDERSTANDING BIOLOGY

JOHN TYLER BONNER, Associate Professor, Department of Biology, Princeton University

There has been a great fashion in the last few years for general education; the old barriers of specialization are to be torn down, and all knowledge must be woven together into a simple and sustaining network. As from all fads, good and bad has come of it, and the best of the good is the fact that we have all reexamined the way we teach. Although new conventions are very likely no better than old ones, we have in the process of making the change actively thought about the mechanics of teaching and have not simply parroted the methods of our predecessors. However, I also believe in the principles of the new education, although I am most impressed by the salutary effect of the change and the self-examination. The new philosophy of integrating and broadening is, like all new ideas, an old one, and it has given a rational excuse (which university professors always require in any line of action) for attempting a better job of teaching.

For the last few years I have been teaching such a course in general biology; it is a "dis-

tribution" course meant for those students who are quite certain they will never pursue biology any further. Sometimes in the beginning when I was particularly discouraged, I used to think that those who had elected my course had done so because they were absolutely positive that they could not be interested in the subject. At first, I had grand ideas and gave, for instance, a series of lectures showing the relation between other branches of learning and biology. I talked for a long time on the place and importance of Leonardo da Vinci and Goethe. However, it soon became evident that these freshmen historians, economists, philosophers, and literature scholars were as yet ill-prepared for such unifying ideas, for not only had a great number of them failed to realize previously the importance of these men in biology, but my lectures turned out to be the first knowledge they had of their existence at all. My disillusionment became complete when, after giving one of these lectures that took such time and care to prepare, a student came up to see me. I thought at last I had reached one person in the hundred there, and felt for a moment warm with pleasure, but that feeling lasted only a short while, for he asked me not about Goethe, but how long after cutting one's jugular vein did it take to die.

Shortly after that, I had a visit from a research fellow in general education (unfortunately I no longer remember his name) for there was a period when they were as numerous about the campuses as text-book salesmen. When he asked me about my revolutionary new methods and ideas I came close to breaking down completely and confessing to him that all I could think of doing at the moment was removing every new idea I had and returning to as conventional a course as possible. I then began to question him about his views and his findings in his travels from one university to another, and he said something that set me thinking and working; he planted a seed that has grown.

He said that he had noticed that all people giving general education courses in science complain about how stupid and unresponsive the freshmen are, and how they would prefer giving their courses to seniors, while people in the humanities feel that the freshmen are more intelligent, more responsive, more eager to learn than upperclassmen. The reason for this, he said, was simple to see: in the humanities, such as literature, any novice can have definite, however unsophisticated, ideas concerning morals, taste, human conduct, and so forth, for these are problems common with his experience, but in science he can have no ideas of any interest until he first accumulates facts. So, in a science there is bound to be a long period of fact gathering that is likely to bear fruit only after the course is over.

Prof. Bonner kept his audience whimsically amused at the Boston meetings of the NABT with this account of the approach used in the general biology course at Princeton. It stands, however, as an original approach to the problem of disinterested biology students.

There must be some way in which a science can be taught so that from the beginning the student can understand and make intelligent, assured comments. It occurred to me that in biology it would be particularly easy and interesting to start with animal societies. Let me give you a rough sketch as to why this might be so.

Many an afternoon have I spent at a zoo watching the baboons on a "monkey hill." Each time it is hard for me to leave when the time comes to go home. I know it is not because I am a biologist that my interest is so aroused, but because I am a human being, and all the other fathers and children and mothers watch with the same keenness. We watch as though we were looking through a one-way glass, and we see them in their living rooms, their dining rooms, their bedrooms and their toilets; they seem to cary on a complete existence and are not abashed by our staring eyes. The old males jealously guard the females of their harem; the young coyly eager females in heat try to attract the attention of the males; the frustrated bachelors sit and watch, and perhaps the most consciously felt of all are the mothers with their small babies which bring feelings of tenderness in each of us. They fight for food; they fight for females; they mate; they groom one another; they excrete; they play; and the mother helps the whimpering infant that cannot climb up the rock to join her.

I watch fascinated because I know without thinking that in all this buzzing activity I see my own emotions, my own desires and aversions. It is impossible to watch without projecting oneself into each situation, and it is not just that baboons have human faces and postures. That is part of it, and the rest are the actions themselves.

In this colony, even though it be rather artificially placed there by the zoo keeper, there is a unity and an even more obvious complex interrelation between all the individuals. For instance, there are the harem groups centered about fierce old males, and the existence of all the other monkeys seems to radiate outward from these centers. There is an elaborate social structure, and a multitude of interlocking social activities. If one analyzes this society carefully, then it is possible to sort out, and see its nature and its living properties more clearly. It becomes obvious that in animal societies (as well as in all other living things) lie the basic principles of biology. Animal societies, single cells, or multicellular organisms are all living, and one as well as the other can be used to illustrate the life functions.

To put the matter with utmost brevity, all animal societies have certain basic activities in common. Of these three have been chosen: a society takes in food so that its individual members may be nourished; a society perpetuates itself by reproduction; and a society has some coordination, some integration or communication between its members. The fact that all societies have these activities means that one can compare one society with another, and most especially, compare the methods in which they perform these activities. There is no reason to expect that they do perform them in the same way, and perhaps the importance and the interest of the comparison is to see how the same activities can be performed in different ways.

Social groupings have occurred in a number of different places in the animal kingdom, and one could pick a number of examples from the higher animals. If we look to lower forms, then we find that by custom we no longer dignify their groupings with the word "social," but instead use "colonial," and these colonies also take in food energy, reproduce and are integrated. Soon it becomes evident that any living unit, whether it be a society, a colony, or an individual organism of one or many cells, they all, as a unit, perform these three activities. This is an easy road to pursue; one can compare the manner in which different units of life perform their living activities, and in this way see, and perhaps to some extent understand, the extraordinary variety of living things.

For the past two years I have been teaching a distribution course along these lines, and I should like to give a brief outline of the sequence of the subjects considered.

We start with a discussion of howling monkey societies based entirely on the field study of C. R. Carpenter. In the treatment of each society, the major stress is placed on the feeding, reproduction and coordination of the group, as well as the evolutionary significance of the grouping with a particular emphasis on the possible survival value of the grouping itself. The fur seals of the Pribilof Islands are considered next, and this is followed by a summary of F. F. Darling's work on the red deer of Scotland. These three mammals represent extremes in habitat as well as in social activity. The howling monkey, for instance, is very democratic, while extreme dominance of the old harem males is seen in fur seals and red deer. Again the howling monkey is reproductively active throughout the year, more or less continuously, while the red deer has a short mating season, but remains in some form of herd or aggregation all year. Finally, the fur seal is only social during the short summer reproductive period when they haul out on the beaches of the Pribilofs. The section on mammals is concluded with a discussion of the beaver, who in having a family as the social unit, foreshadows the situation in insects.

To introduce the subject of insect societies, there is first a general discussion of W. M. Wheeler's famous lectures on the origin of insect societies in which, among many other things, the matter of the independent origin of the different insect societies is emphasized. Wheeler estimates 24 separate successful and independent attempts. This is precisely what was found in the social mammals and illustrates the point that social grouping must have selective advantage in evolution. There must be a constant selection pressure among many animals to move in this direction. Then, the work of T. C. Schneirla on army ants is discussed, as well as the habits of termites, including some mention of the modern work on caste determination.

In proceeding down the scale, colonial hydroids are examined, first by introducing the subject with a description of the structure and activities of the degenerate fresh-water Hydra, and then by examining Obelia and the polymorphic colonial forms such as Hydractinea and the Siphonophores.

This is followed by a consideration of the whole problem of cell colonies where again

there appear to be numerous independent attempts at a social combination. Four of these are chosen, representing four different cell types: the colonial ciliate, Zoothamnium, the colonial flagellate Volvox, the colonial amoeba or cellular slime molds, and the colonial or slime bacteria. This downward swing reaches its base in a discussion of feeding, reproduction and coordination of a single cell. A complex ciliate is used to illustrate how, like a miniature Swiss watch, a single cell can perform its living activities as efficiently as a large group. And in each downward step, as one approaches the single cell, it is possible to surreptitiously infiltrate into the student the facts and principles which we more commonly associate with biology rather than animal sociology or animal psychology.

In discussing the single cell, the question now arises why do organisms feed, what is feeding, and why is it necessary. A short excursion into the nature of energy, and matter, and more particularly the energy turnover problems of metabolism and cellular respiration give a deeper understanding to the biological problems. In the same vein, some superficial understanding of the chemical nature of protoplasm and a short discussion of what is involved in growth, in the synthesis of new protoplasm, also helps to give perspective.

Now it is possible to weave back up again through the higher multicellular forms, and this, although it involves in itself almost half the course, hardly needs restatement for it is the main substance of conventional biology. In each case, and each example, the three living functions are considered, and always an attempt is made to unify the discussion of the whole course about this simple theme.

I will not pretend that such a scheme has, in all respects, been instantly successful. One of the difficulties created by the system was that with a fairly large class there was no possibility of discussion with the students, of mulling over problems with them and observing their response. Their thought process could only be gauged in the examinations, for the lectures consisted of the customary orations with little or no give and take, while the laboratory possessed a sufficient amount of the customary chaos to prevent settling down to any problems seriously. Therefore, as an experiment, recently I have been running the laboratory in small groups of ten students for a shorter period of time. By keeping the size down it has been possible to have a combination laboratory and preceptorial. The latter is a system of teaching by discussion groups which has been, since the days it was introduced at Princeton by President Wilson, particularly successful and extensively used in the humanities and social sciences.

Another problem has arisen that might have been expected. The discussions in the first part of the course are intelligent, and the interest and work of the student is high. The great difficulty comes in the transition to the lower forms; one must not leave the student with feelings of regret when one really comes to grips with the straight biology. It is a matter of integrating the two portions and avoiding evoking the kind of response I received from one student the first year the experiment was tried. He came up to me after the first lecture on colonial hydroids and expressed his sorrow that we had left the subject of social mammals and insects, because, as he put it so succinctly, "After all, sir, who gives a damn about a polyp?"

A BACK YARD TEACHER EXCHANGE PROGRAM

WM. H. BANKS, JR., Ecological Research, University of Utah

Editor's Note: Here is a refreshingly new idea for biology teachers. Mr. Banks is formerly of the Louisville Public School System. His present address is: Ecological Research, 4050 D Area, Dugway Proving Ground, Dugway, Utah.

In recent years the practice of international teacher exchange ("swapping" an American teacher for a foreign colleague) has become established in our colleges and secondary schools. Instructors of English, history and modern languages, to cite but a few examples, derive untold benefits in practical experience and sheer pleasure from living in an environment close to their subject fields.

But, has anyone advanced the idea of a teacher exchange program *within* the United States?

Teachers of many disciplines would derive benefit to a greater or lesser degree from traveling about the country, but exceptional opportunities and benefits would be afforded the biology teacher through such an experi-

ence. The chemistry or physics teacher, for example, is little attracted to outside areas, for properties of matter do not vary with geographical placement. On the other hand, the naturalist who is uprooted from Ohio and dropped into Florida finds himself in a new world! The lush greenery of the Great Smokies startles the native of the grand Rockies! Although the biologist recognizes certain principles in operation everywhere, in no two places does he find identical conditions. Comparison of two areas and reapplication of known principles to new situations is not only a thrilling experience, but to the biologist it is an integral part of professional growth and maturation.

Newer techniques in biology teaching stress utilization of materials—bringing the student into direct contact with the out-of-doors. The teacher who has traveled extensively—one who has seen and studied at first hand the life phenomena of various places—is prepared to deliver a much more dynamic classroom presentation. A teacher exchange plan would provide the opportunity for teachers of biology in secondary schools to study nature in a different locality, perhaps on the other side of the continent!

What problems would be encountered before such an exchange could be put into operation? The first barrier could well be the requirements for teacher certification which vary from state to state. Are the differences so great as to prove prohibitive, or could this obstacle be circumvented? What would be the attitudes of state boards of education to such an exchange? Would school administrators support the idea?

Every state board of education has its own more or less standardized course of study for which its biology teachers are held responsible. At first glance this lack of uniformity might discourage teachers from participating in such a program, but does not this variability in itself present a challenge? What new things are to be learned about biology teaching in other sections of the country? What can be contributed to the biology teaching of other states? While journals and various professional publications provide a ready medium for the exchange of ideas, they can never replace the value of personal experience.

Other than the typical administrative problems such as housing, salary differentials and transportation, what would be the routine procedure of teacher exchange? How could a teacher go about submitting his name and request for exchange? What agency would be best qualified for handling the details?

The possibilities are intriguing and almost unlimited. This could be that once-in-a-lifetime opportunity to see the spring wildflower display of the Mojave, to study the lakes of northern Minnesota, to hike the breathtaking Appalachian Trail, or to collect the spectacular abalone on the coast of California. This could be that chance to exchange ideas, to learn new facts, to build up a better collection of diverse specimens, to assimilate new experiences, to gain a refreshed appreciation of the scope of biology and biology teaching!

Looking at this thing personally, "How could *you* benefit from such an exchange?" An immediate need in the promotion and exploration of the potentialities of this idea would be a poll of American biology teachers at all levels.

"Where would you like to teach next spring?"

STUDY NATURE BY EAR

LOYE MILLER, Professor Emeritus, University of California, Los Angeles

Biology is also nature study. Prof. Miller writes beautifully of an oft-ignored aspect of the process of observing nature.

"To him who, in the love of Nature, holds communion with her visible forms, she speaks a various language."

Bryant might just as well have used the expression "audible forms," for nature is full of all sorts of sounds. What's more, since the source of that sound often eludes with tantalizing persistence our actual physical vision, the ear is the only avenue of approach to our consciousness. I would strongly urge you to learn to listen with greater accuracy.

There are certain advantages to accurate listening. You will have "eyes in the back of your head," so to speak. Things don't

catch your eye except as they come within a narrow visual angle. You can hear, however, through the whole 360° of your horizon. You can hear through the leafage of a tree or the sedges of a pond, through the darkness of the night sky, or around the corner that has so long baffled man's inquisitiveness. I spent a week once, flat on my back, in a city-smothered hospital, yet 14 species of invisible birds spoke to me of the pleasant out-of-doors, and they spoke a "various language."

But how can I learn to listen? Of course, one could say "by listening." Rather, I would say, by discriminative and analytic listening. Perhaps I can help you in your learning.

Sounds have very definite characters of their own, and some of these peculiarities can be picked up by the human ear after a little practice. Others are caught only by delicate instruments which we must leave to the acoustical laboratories and technicians to work out. The results of their work, however, may aid us in making our ordinary perceptions of sound more sharply discriminative.

The scientist picks things to pieces in order that his mind may better grasp how they were made up in the beginning. I contend that this picking to pieces is, in the long run, a constructive process if we don't stop with just the pieces. A monkey or a small child can tear apart a lot of things, but only the growing child's intelligence can put together in the brain a reconstruction of the thing destroyed. Let's pick some of the sounds of Nature to pieces, see if we can understand them better, learn more readily to recognize them, and know the wild folk who made them.

Most of you know that we hear because certain waves or vibrations in the invisible air are carried to the ear drums. The force with which these sound waves strike the ear will determine the loudness of the sound, their frequency determines within limits the pitch, while their forms (i.e., simple or complex) will determine the timbre or quality. A single sound then has loudness, pitch and timbre. Add to this fairly simple beginning the further statement that a series of sounds may have rhythm, interval, inflection, and purpose, and one may at first be discouraged. You should, however, be encouraged to feel that there are so many characters to lay hold upon.

Our estimate of the loudness of a sound is always dependent upon our notion of how far away the creature is who makes the sound. In other words we must "refer the sound to its point of origin." For example, there is the relation of the object to other objects. If you'll stop to think of it, we get echoes of sounds from hillsides, cliffs, rocks or even trees. Sounds coming over a plain, or over quiet water, or from the sky are always difficult to refer. On the ground, however, there are devices that can be applied. A crude type of triangulation has proven very useful in my own field work. It is somewhat as follows: From the spot where you first hear the sound, determine the direction from which it comes and draw an imaginary line from your station to the source of sound; now move at right angles to this line as far as practicable, and draw another imaginary line. Where these two lines intersect is the location of the source. What school-teacher hasn't done it in the class-room?

This device has proven of great use in locating owls at night. Their voices are often most elusive in the dark because of a muffled quality and varied loudness. They are frequently reduced to a mere breath, without change of pitch or quality. The whisper songs of autumn or winter birds are sometimes so ventriloquistic as to be referable in no other way. A Hermit Thrush may sing full throated from deep woods, or he may whisper from a point less than ten feet distance, and such an elusive sound it can be!

The pitch of a sound differs with length of the waves or frequency, as we may say. In a pond or small lake the short water waves come lapping upon the shore with great frequency while upon the sea beach the great waves roll in at long and pounding intervals. A series of short or frequent sound waves produces a high-pitched tone; the less frequent impulses produce a lower one. Even the most "tone deaf" person can usually distinguish the child's voice from that of the man merely by the higher pitch. After the same amount of experience out-of-doors, as he has had indoors, he could probably tell a Timber Wolf from a Coyote or a Horned Owl from a Spotted Owl. Tiny birds have tiny pipes upon which to play while, in general, the larger pipe is found in the larger bird. There are exceptions, however. The female Horned Owl is larger than her mate, but her musical instrument is smaller; so she produces a tone some times a major third higher in pitch.

If you are musically inclined, and carry a pitch pipe into the field, you will be surprised to discover that each bird has a remarkable fidelity in this matter of absolute pitch.

There is some variation due to sex, or to the age of the individual but, you will discover, variation is surprisingly slight.

True it is that the pitch of a single note may not remain constant throughout its duration. It may have a rising or a falling inflection. We use the syllable "whit," or perhaps "chip," for the note of a small bird. To me the one has a rising inflection, and the other a falling off or a flatting. The first note of the Horned Owl is quite un-inflected, whereas the three following notes turn slightly down. The whole performance might be diagrammed. The calls of the Green-backed Goldfinch might be syllabified "*tseah, tsweet-teet teet.*" Thus we may detect in a single note either a slight or a marked change of pitch during its brief duration.

Repetition of the same call is commonly rhythmic to a remarkable degree. Nature is full of rhythm. The spring crowing note of the California Quail is repeated at intervals of about six seconds. The single hoot of the California Pygmy Owl is repeated with almost metronomic regularity at about 60 notes per minute, whereas a slightly different species from the mountains of southern Arizona steps up the rhythm to 70 or more per minute and raises the absolute pitch. Snowy Tree Crickets chirp at a quicker, throbbing tempo in the warmer hours of early evening, but slow down very definitely as the temperature drops in the night.

But how about that word melody? ("A sequence of notes that conforms to a mode" —Webster.) Most assuredly we do in Nature get sequences of notes, and if we are sufficiently charitable in our interpretation of "mode," there will be no dearth of melody. Sometimes, we even get brief sequences that conform perfectly to those modes that have ripened through the ages in the evolution of human music. (*I* have not yet mastered Schönberg's 12-tone scale.) I once heard a Mountain Coyote bugle a perfect motif from the oratorio "Elijah." Meadowlarks often include, in their incomparable songs, some sequence in a major key which could be noted on the musical staff without the least distortion. The song of the Mountain Chickadee includes a minor interval; the Golden-crowned Sparrow starts out with the same interval as the chickadee, and then wanders off the key and stops as though abashed by his mistake.

But why should we impose on the wild performer a human "mode" just because we like it? I like a Song Sparrow even though he doesn't sing "on the key."

Seldom can a bird's song be recorded on our musical staff without a hopeless distortion that proves fatal to its spirit. I have, therefore, used certain hieroglyphics that recall to me the song patterns of birds, though they may mean nothing to another person. They bring back to "the inward eye" the memory of an event that might otherwise be lost.

These sound waves that we began talking about in the first paragraph—these unseen waves in the atmosphere that beat upon the eardrum and rouse such wondrous stimuli—they are not so simple as one might suppose. A single tone is seldom a simple tone. Those visible waves of the water surface with which we compare them are seldom simple waves. Even a "glassy sea," that sends smooth breakers gliding up onto the beach, commonly has more than one size or frequency of wave on its surface. Let but a gentle breeze spring up, and each of the great swells will have a multitude of ripples racing over its surface, though the fundamental swell remains undisturbed.

So, with the sound waves, we get complexes. Smaller disturbances join with the greater to make what we call a fundamental with its overtones. The result is what we call timbre or tone quality in any particular voice. The sound of a flute is different from that of a clarinet; the sound of a bugle is different from that of a violin, although they may all be playing the same tune.

The voices of the big outdoors are often recognizable, not by what they say but by how they say it. The timbre of voice quality becomes familiar. Suppose you watch a Meadowlark high on his singing post some bright spring morning. He will sing the same sequence of notes for a variable number of times, and then will "put on a different record" that has a totally new sequence, but it will still be a Meadowlark song, and no one could mistake it. I have watched a single bird sing three different patterns, all within the passing of five minutes, without changing his perch other than perhaps to turn around. One of my students recorded eight different song-forms within a 20-acre area one spring, yet they were all unmistakably Meadowlark songs.

The Horned Owl has a mellow voice, the Crow has a raucous one. The California Quail has a reed tone, the Sierra Grouse a muffled, hollow boom, the Green-backed Gold Finch has a thin, wirey piping, the call of the Russet-backed Thrush is a liquid whistle. The voice of the California Thrasher has a bit of Scotch burr-r in it.

Why not bestow a similar attention on the sounds of the big outdoors? The Indian did so because his safety or his sustenance often depended upon his interpretation of the slightest sound or the absence thereof. The primitive hunter may be in search of nourishment —the naturalist may be in search of " food for the spirit." Let's learn to listen.

Skull-duggery: A Note About Piltdown Man

The recent expose of Piltdown man by British scientists has turned out to be what seems the greatest anthropological hoax of the century. To the biologist the matter is not disturbing because the story really confirms what was somehow sensed all along. The Piltdown find has always been a bone of contention ever since the day of its announcement by Charles Dawson, the amateur archaeologist who discovered the bone fragments near Sussex, England around 1912.

To the lay person untrained in the disciplines of biology, the newspaper account of the story may be seriously misleading. One might quite easily lose some of his confidence in science and scientific method in learning that scientists had permitted such a gross error to be perpetuated over so long a period of time. A very few individuals, lacking a friendly attitude toward biology and the idea of evolution, might be prone to use this single, isolated case to discredit the whole notion of man's origin as depicted by science.

To make a case against the scientist on this matter is foolhardy since the evidence supporting evolution is so overwhelming. Contrary to popular notion, it is quite certain that the Piltdown hoax will not revolutionize man's thinking in regard to evolution. The main value of the hoax rests with the fact that it illustrates beautifully the dynamic and self-correcting nature of science and scientific procedure.

Communications

While a student at the State College of New Mexico, a friend and I spent countless hours wandering over the dry desert that is so characteristic of southwestern New Mexico. One of the things that intrigued us was a round circle of small stones that were held together with webbing. In the center of this circle was a hole about one-fourth of an inch in diameter. We knew it was the home of a spider, but each time we tried to dig one out the sand caved in, and we lost the tunnel. After some thought we hit upon the following idea. The top two inches of sand was dry and whitish. The sand below this was moist and red. We took the fine dry top soil and poured it into the hole. As we removed the sand we followed the white sand to the bottom of the spider's nest. This system may be used very efficiently on the sand along the beaches. Russell Pengelly, 158 Lewis, Klamath Falls, Oregon.

An interesting program now in progress at Columbia University is under the direction of the Institute for the Study of Human Variation. This organization was set up to initiate a coordinated study of the biological factors concerned in human variation, and of the processes by which changes in the biological constitution of human populations occur. Experts in the fields of genetics, anthropology, statistics, and biological areas are pooling their separate disciplines in research and in training other investigators in the field. An interesting curriculum has been set up for students interested in this area between the biological and social sciences.

AUDIO-VISUAL NEWS

HAVE YOU HEARD?

. . . A new live action film, in color, of insectivorous plants has been announced by the State University College of Forestry, Syracuse, N. Y. Dr. William Harlow, well known as an author, photographer, and biologist, has produced: "Insect Catchers of the Bog Jungle," a portrayal of the insect trapping activities of the pitcher plant, sundew, and Venus flytrap.

. . . If you sent for Disney Studios' brochure on the True-Life Adventure Series, announced in last month's news items, you learned that a third full-length feature production is being assembled, which will deal with the minute forms of life. With John Nash Ott, Jr., announced as one of the collaborators, we can expect some fine sequences in which time-lapse photography is employed.

. . . The National Wildlife Federation, currently producing a series of brief, attractive pamphlets on fishing baits and how to build brush shelters, V-dams, and other structures for improvement of fishing areas, plans to accompany the pamphlets with related strip films, sound tapes, and 14-minute color films.

. . . The U. S. Department of Agriculture is interested in knowing how you react to USDA films, particularly with regard to a possible need for more human interest, story, and dramatic treatment. Send your comments to the Motion Picture Service, U. S. Department of Agriculture, Washington 25, D. C.

THE STATUS OF NARCOTIC ADDICTION IN THE UNITED STATES

LOIS HIGGINS, Director, Crime Prevention Bureau, Chicago, Ill.

Those who attended the Boston meetings of the NABT will not soon forget Dr. Higgins' experience-punctuated account of narcotic addiction in the U. S. This is an edited version of her remarks. Teachers will find this excellent source material for a unit on drugs and narcotics.

The menace of drug addiction today hangs like a Damoclean sword over our nation. Thousands of young Americans are victims of the dope habit and, as their number increases, so too does the total of crimes in our communities. Concurrent with the rise in addiction comes a wave of lawlessness terrifying in its implications, with police blotters across the nation daily listing the names of more and more youthful offenders, and behind those names listing every crime in the books.

While we tensely turn our eyes across the seas, while we build and man the outposts thousands of miles from our shores, while we join other free nations to resist the threat of Communism in other parts of the world, our Communist enemies are waging a deadly and tragically successful war against us here at home. Narcotic drugs are some of the weapons they are using with devastating effect.

I shall not presume to set myself up as a medical authority on narcotics and drugs, nor on the physiological or psychological medical aspects and treatments of drug addiction. I have, however, conferred with many recognized medical authorities on this subject, have carefully studied the available literature, and collaborated with experts on articles combining the viewpoints of the law enforcement officer, the social worker, the educator and the medical doctor, concerning drugs and drug addiction. I make this statement because I recognize that there is sometimes a divergence of opinion between members of the medical profession—particularly those who consider the fact of drug addiction exclusively as such —and law enforcement personnel who may tend to consider drug addiction strictly from the standpoint of law enforcement.

THE NARCOTICS PROBLEM IN GENERAL. Admit it or not, narcotic addiction is a national problem. While many of our cities are openly, actively and courageously fighting the drug traffic, others are burying their heads in the sand and denying their troubles.

Too many of us still think of old, badly written and poorly produced movies on "Marijuana." All we can remember about these cheap films are the sensational advertising behind them and the vague, trite, amateurishness of the direction, acting and filming. Perhaps we still think of movie scenes of Chinese opium dens, when someone mentions dope to us today. You'd be amazed how many Americans associate the word "narcotics" with those fantastic movies and are thus inclined to minimize the very real danger of drug addiction all around us.

Well-authenticated evidence, independently gathered and confirmed by numerous agencies, including Military Intelligence and the Federal Narcotics Bureau, positively links the Communists with the upsurge in narcotics trafficking throughout the free world. Opium and heroin from Communist China is, and has been flooding the world market. However, thoughtful observers of the Communist drive for world domination believe that the money thus obtained is a secondary objective. The primary objectives, these observers declare, include the destruction of potential fighting personnel, destruction of public confidence in law enforcement and other public agencies, a mounting spiral of crime and juvenile delinquency, and an overall decline in civilian morale.

Let us attempt to determine how effective are the deadly Siamese twins of crime and Communism in this war within our borders. It is very difficult to accurately estimate the number of drug addicts, but the most commonly used estimates conservatively place the total between 50 and 75 thousand. To say the very least, I believe that these are exceptionally conservative estimates. The fact of narcotic addiction is not in itself an offense in most jurisdictions. Thus, drug addicts generally become involved with the law only when they are apprehended on some other

charge, at which time the fact of addiction becomes known. Addiction has been likened to an iceberg, with only one-ninth of its mass showing above the surface. At least, as far as marijuana smoking is concerned, I believe that simile to be tragically appropriate.

Let no one of you underestimate the danger contained in this harmless-looking marijuana cigarette. This is our enemy's "Trojan Horse"—the vehicle used by the vicious drug traffickers to open the gates to the victim's mental, moral and physical destruction. Had it not been for that first marijuana cigarette, we could count the youthful drug addicts by the tens instead of by the thousands.

WHAT IS NARCOTIC ADDICTION? There are several definitions of narcotic addiction, which might be summarized as a condition in which a person finds himself unable to voluntarily discontinue the use of drugs, and becomes more and more desperately dependent on these drugs. The addict is, to paraphrase William Shakespeare, "in the drug habit so far steeped that he can neither withdraw nor advance, of his own volition." He is a prisoner who is helpless to take advantage of an open door through which he might escape—a prisoner who actually fears the outside world, and finds his only security inside his jail.

The Expert Committee on Drugs Liable to Produce Addiction gave this opinion: "Drug addiction is a state of periodic or chronic intoxication detrimental to the individual and to society, produced by repeated consumption of a drug (natural or synthetic). Its characteristics include: an overpowering desire or need (compulsion) to continue taking the drug and to obtain it by any means; a tendency to increase the dose; a psychic (psychological) and sometimes physical dependence on the effects of the drug."

There are other views of what constitutes an addict, and two in particular seem quite appropriate. The addict is said to be "any person, regardless of the traits of his personality, who uses narcotic drugs casually until he suffers distress when the drugs are withdrawn, and who becomes aware of the relation between this distress and the withdrawal of the drugs." Stated another way, the addict is "any person who habitually uses any habit-forming narcotic drug so as to endanger the public morals, health, safety or welfare, or who has been so far addicted to the use of such habit-forming drugs as to have lost the power of self-control with reference to his addiction."

Of course, we must also consider whether this addict is an adult or a youngster. These are separate classifications insofar as treatment is concerned, and both present problems peculiar to their particular pattern. It is my personal observation that the adult addict is generally an emotionally immature and unstable individual—living in a slum, fringe or highly transient area. He is an individual unwilling to face reality, with little opportunity or desire to identify himself with others through membership in church groups or civic, social, fraternal or welfare organizations. He becomes addicted because of proximity to an addict—his motivation is the desire to escape reality.

The same personality defects which lead to excessive drinking of a compulsive nature are generally to be found in the adult drug addict. Sometimes this failing is referred to as an "occupational hazard," with the availability of the drug leading to its initial use to relieve the nervous and physical strain of his work. Youngsters of high school age, on the other hand, generally are attracted to the narcotics use for reasons almost exactly opposite those of adults. Rather than "escape," they seek a sense of "belonging," of being recognized as "regular" and "one of the gang." The vast majority of young people have "heard about" marijuana and heroin before beginning its use. Many thought of marijuana in terms of its alleged sexual powers and were fascinated by these ideas.

DANGEROUS "THRILLS." In general, the preliminary introduction of it by a "friend" or "some of the guys," stresses the thought that marijuana is harmless, and that they would be able to take it "for laughs." As the body develops a tolerance for marijuana, they appear to switch naturally to heroin, also through others already using it. This switch is generally when the individual believes he is "different, and smart enough not to be hooked."

The daily dosage seems quickly to mount to between four and six capsules, costing $1.50–$7.50 each. In the beginning, the youthful addicts invent elaborate stories to obtain money from parents, friends and relatives. Then comes pilfering of objects within the home. If a high school student, he finds his earnings inadequate to purchase the needed supply of drugs. Generally in the company of another addict, he starts out by robbing

news stands, then stripping automobiles, stealing packages from delivery trucks, shoplifting, burglary, purse snatching, and an occasional strong arm robbery. A small percentage become "runners" or "pushers" for the drug peddlers, receiving one capsule for each four they sell. Girls turn to shoplifting and prostitution.

THE COMMON NARCOTIC DRUGS. OPIUM, "mud," or "pin yen" is a powerful narcotic which is used to procure sleep and to bring relief from pain. It is obtained from the juice of the immature seed capsule of the wild poppy. This juice flows out in the form of a milky liquid which soon hardens and turns black. It is then scraped off and dried thoroughly. Next it goes through a kneading process and is molded into cakes for balls for the market. According to the Encyclopaedia Britannica, the yield of opium is smaller in temperate than in tropical regions, and the industry can be profitably carried on only where labor and land are sufficiently cheap and abundant. The fact that labor must be cheap to realize a profit, coupled with the fact that women and children are used to a great extent to cultivate the crops, only adds to the menace of the drug. The active constituent of opium is morphine. During the past ten years or so, according to law enforcement authorities, Chicago has not been troubled with opium smoking, and very few opium raids have been made.

MORPHINE is one of the most important derivatives of opium. It is a fine, white odorless powder which packs like snow and has a bitter taste. There is no drug yet discovered that can equal morphine in pain-relieving power. It is often put up in small tablets and cubes. Addicts usually inject it hypodermically into their legs, arms, or abdomen, because it is more rapidly absorbed this way. It produces a pleasant, tingling, "pleasurable sensation" which spreads throughout the body bringing peace and comfort. According to authorities, there are few morphine addicts in conflict with the law today.

HEROIN, "H," "scat," "boy" is a coarse white powder which has a bitter taste. It is a product of opium and according to pharmacologists, 5 to 7% of the opium gum (made from the seed of the poppy plant) may be converted into heroin. The technical name for heroin is diacelylmorphine. Addicts can "sniff" or "snort" heroin using a straw through the nose, as it can be absorbed through the nose. But some prefer to take it with a needle hypodermically. Heroin is an outlaw drug, a contraband drug, a bootleg drug—which means that it cannot be imported legally into this country. It cannot be manufactured, sold or possessed legally in the United States.

HYPOCRISY OF HEROIN. Although there is no medicinal use for heroin in medicine, and physicians cannot prescribe it, druggists are prohibited from handling it, the fact remains that heroin is the most widely used drug among addicts today. Heroin capsules sell for $1.50 each and have been readily available, according to addicts questioned. The public is aroused, as well it should be, and in view of the increased traffic in heroin, keeps demanding to know where it is coming from and why the Federal Government does not provide greater protection against the illicit importation of it.

CODEINE is an alkaloid obtained from opium and one of its active medicinal principles, similar to morphine. It is feebler in its effects.

COCAINE is a powerful, white, crystalline alkaloid extracted from coca leaves and much used as an anaesthetic and narcotic. Its habitual use is most deleterious both physically and mentally. It is known as "snow," "C," "happy dust," "cutie" or "girl." It has a bitter taste and a cooling effect on the body tissues. Addicts may apply it to the mucous membranes by "sniffing or snorting" it, or they may take it hypodermically. Cocaine is a dangerous, insidious drug because it is extremely rapid in its conquest and produces demoralizing effects. At the present time, it costs about $2.50 a capsule for the addict.

A combination of heroin and cocaine is called a "speedball," and since these drugs have mutually exclusive reactions, the addicts claim the combination produces a different and greater sensation. Marijuana and hashish are practically the same kind of narcotic—both drugs being extracted from the hemp plant. *Cannabis indica* and *Cannabis sativa* are the technical names. Addicts smoke marijuana, or chew it. The cigarettes are called "reefers," "goodbutts," "stick," "muggles," "Merry Warner" and many other names. In quantities it is called "tea," "loco weed." Reefers sell from 25¢ to $1.00 each.

TYPES OF NARCOTIC ADDICTS. Broadly, narcotic addicts may be divided into the following classes: Persons, who, on a physician's prescription, habitually take a narcotic to allay severe pain caused by chronic diseases;

persons, otherwise normal and law-abiding, who began indulging in narcotics in a spirit of adventure and became slaves to the habit; emotionally unstable individuals who habitually use narcotics with the object of getting away from the realities of life; persons who habitually use marijuana or hashish as a sex stimulant.

It would seem that almost any personality type, including the normal, may develop the drug habit to escape from conflicts. It is an artificial escape; it brings solace to the user, deadens pain, brings about forgetfulness, and minimizes, at least for awhile, in the user's mind, the difficulties he is facing. It produces a confidence and a sense of peace that the user would not otherwise feel. He is relieved of burdens, his insecurity disappears, and he finds instead what he interprets pleasurable sensations. As soon as the effects of the drug wears off, he becomes morbid, morose and depressed, concerned only with the next dose —how and where he will get it.

COMMON PHYSICAL INDICATIONS OF DRUG ADDICTION. The common indications of drug addiction are: a grim, haunted expression, a peculiar glistening look in the eyes, trembling hands, sallow skin, wan cheeks. In a sniffer usually, there is a redness or swelling in the partition of the nostrils, or ulcers on it; in one who takes his dose hypodermically, the skin is usually covered with a rash from needle pricks on the arms, legs or abdomen—some addicts use an eyedropper, safety-razor, blade, safety pin, or the like, instead of a hypodermic needle; periodic "yen" or craving for the drug, with symptoms such as water running from the nose or eyes, frequent yawning and sneezing, continually itching arms and legs, and dilation of the pupils.

The psychic action of marijuana is said to consist of: a feeling of happiness, the characteristic state of euphoria, intellectual excitement, dissociation of ideas, and exaggeration of sensations, errors in time and space, intensified auditory sensibility, fixation of ideas, these usually have a suggestive origin due to the influence of the outside world; over-excitation of sensations and emotional disturbances, during which the addict loses the power to control his emotions and may commit acts of violence; irresistible impulses, always of a suggestive origin, which may lead to suicide; numerous illusions and hallucinations. Whatever the addict imagines becomes clearly visible to him. Marijuana intoxication may be divided into four periods: nervous excitation; hallucinations and mental instability; ecstasy and profound repose; sleep which terminates the intoxication.

The mental and moral sense, as well as the physical being, of a drug addict becomes affected. A state of mental depression occurs which can be relieved for a time only by increasing the doses of the narcotic. Responsibilities are neglected, appointments are not kept, no reliance can be placed on any statement made, since addicts are notorious prevaricators. If drugs are withdrawn for a period of time, withdrawal symptoms become apparent. This usually takes about 12 to 18 hours after the last dose. This person exhibits tremors, uncontrolled twitching of muscles, vomiting, severe cramps in legs, back and abdomen, diarrhea, extreme loss of weight during the next few days. There is some fever, some hot and cold flashes. Anyone who has ever witnessed a drug addict "running cold" or "kicking the habit" can never forget the sight. This sickness lasts from a week to ten days. But, rehabilitation lasts anywhere from four months to a year, depending upon length of addiction.

There are people who claim that drug addiction should be regarded as a disease rather than a vice. They say that once it has developed, it requires special care and treatment just as much as a case of smallpox or typhoid fever. Perhaps that is true. Granted, that it takes bodily toll as does any organic disease. But what seems to have been overlooked by many authorities is the fact that a drug addict has a free will, and at least in the beginning, he has the choice of accepting or rejecting the use of drugs, when faced with the desire to use them.

The degree of susceptibility differs in people, of course, and the weak people, the high-strung, unstable, over-sensitive, emotionally immature individuals—these are the people, who under certain conditions, are easily induced to begin the habit.

According to medical and psychiatric authorities, the ideal treatment plan includes physical care, general building-up after the withdrawal illness; an adequate occupational therapy program; psychotherapy, counselling and guidance. The treatment must go beyond the medical care and even after the patient is considered "cured" some type of supervision is not only advisable, but is a real necessity. Unless this supervision (both social and medi-

cal) is provided, the patient may fall into bad habits, seek out his old associates and suffer relapse.

We had to learn how to fight cancer, before we ever made any progress in that field—and yet, we have so much still to learn. It is the same situation in regard to narcotics—if we are to cure our addicts, or halt the spread of this illegal traffic, we must turn and face our enemy in every American community—and fight back intelligently, as a national team. We can't leave the fight to the few who have been carrying the burden—if all of America will join them, work with them, study and plan with them, the menace of drug addiction can be eliminated for all time.

Books For Busy Biologists

SRB, ADRIAN M., and OWEN, RAY D. *General Genetics*. W. H. Freeman and Company, San Francisco. x + 561 pp. illus. 1952. $5.50.

This textbook presents in 24 chapters the basic principles and some important applications of modern genetics. The approach and sequence of topics is logical rather than historical. Special emphasis is placed upon the cytological and biochemical aspects of the subject. A very important part of the book is the illustrations. At the ends of the chapters are well-chosen lists of references and generous numbers of questions and problems. In level of difficulty and variety the material as a whole is probably above the average of recent textbooks in genetics.

EDWARD C. COLIN,
Chicago Teachers College

JOSEPH, E. D. *The Teaching of Science in Tropical Primary Schools*. Unesco Handbooks, Vol. 1, 1953. 234 pp. Oxford Univ. Press, London. $1.00 (United Kingdom).

Although well organized, the "General Introduction" and the first two chapters are lengthy and a repetition of general teacher training. The outline for the six-year primary course is concise; the supplies required are inexpensive and easy to obtain. This handbook should be a valuable aid for teachers of grades four, five, and six in practically any climatic location.

ERMA VANCE,
Fort McKinley School, Dayton, Ohio

BEEBE, WILLIAM. *Unseen Life of New York*. Duell, Sloan and Pearce, New York, and Little, Brown, Boston. xiii + 165 pp. 1953. $4.00.

Many a New Yorker may wish to glimpse the living things he has overlooked about his metropolis, but the professional biologist might have to place his flair for exact scientific accuracy in a straight jacket to get pleasure from this production. The teacher of biology will be quick to see the sweeping generalization that is so far from exact truth in the statement on p. 141, " . . . every plant springs from a seed, every animal from its egg." Beebe continues, "Still another sweeping, all-inclusive statement may be made—every seed or egg at first consists of but one cell, and by the division of this into many cells, the lichen, violet, tree, worm . . . is formed." Surely this eminent scientist must know the structure of the lichen. The personalization of all animal life may become irksome—even annoying. Does a male dragonfish barge "slowly along through life, hoping against hope that a mate will find him before he dies of starvation?" Beebe's fine style shows through on many a page. He could have read his manuscript a bit more carefully, and the co-publishers, likewise, could have avoided some of the typographical errors that have slipped in.

CHARLES E. PACKARD,
Randolph-Macon College

WEST, T. F., HARDY, J. ELIOT, and FORD, J. H. *Chemical Control of Insects*. John Wiley & Sons, New York. xi + 211 pp. illus. 1952. $3.25.

The rapidly growing list of insecticides, repellents, and attractants makes this recent summary an easy method of keeping abreast of the latest developments. The precise effects of the various chemicals, dosages, and composition are told in an easily readable style. Entomologists will find this British review quite valuable; general biology teachers may find it a handy reference. Included is a chapter on weed control.

PAUL KLINGE, *Editor*

DEITRICK, J. E., and BERSON, R. C. *Medical Schools in the United States at Mid-century*. McGraw-Hill, Inc., New York. xxii + 380 pp. 1953.

Functions of the medical school, its finances, operation, curriculum and teaching methods, advanced education and training are covered extensively. It is a sourcebook which ought to be accessible to every biology department which trains students for medicine and its allied fields.

CHARLES E. PACKARD,
Randolph-Macon College

BERRILL, N. J. *Journey into Wonder*. Dodd Mead & Co., N. Y. XIV + 338 pp. sketches. 1952. $4.00.

Professor N. J. Berrill, an eminent marine biologist at McGill, narrates the story of man's discovery of the natural world by taking the reader on the journey into wonder as did Columbus, the freebooters Hawkins and Drake, the great pirate-naturalist Dampier, the scientist-sailor Cook, the Forsters, von Humboldt, Scott, and the thinker Darwin. These voyages serve as connecting threads

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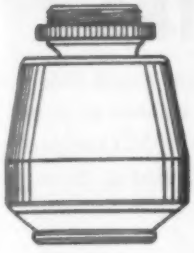

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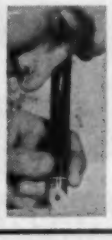

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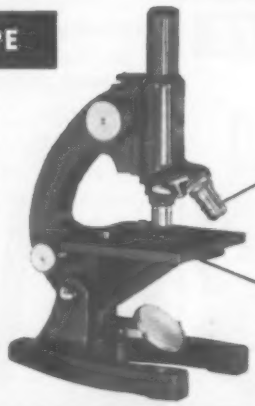

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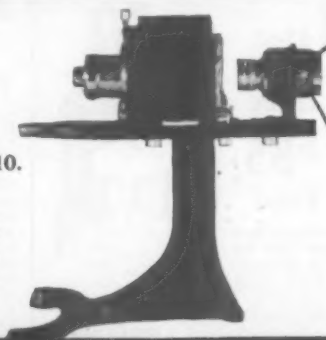

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on which to string bits of history of science; of his own philosophy of modern knowledge about the creatures and places encountered. The topics, the poles and the oceans receive chief emphasis. The book ends with the journey into geological history built about the vicissitudes of the mammals of the Americas. The volume is clearly, simply and well written. It may serve as a review, a summary or as an introduction to natural history for the lay reader as well as the student of biology.

ELMO N. STEVENSON,
Southern Oregon College, Ashland, Oregon

QUIRING, DANIEL P. *Functional Anatomy of the Vertebrates.* McGraw-Hill Book Company. xi + 624 pp. 1950. $6.00.

As found in other texts the anatomy of the systems, and the classification of various vertebrates are included. Three unusual extra chapters are inserted. Form and Structure, Anthropology, and Functional Anatomy.

MRS. ROBERT HODGE

"BIOLOGY IN THE NEWS"

Eat and Stop Worrying, John Kord Lagemann, *Cosmopolitan,* Feb. 1954, pp. 94–97.

A collection of popular myths which keep you from enjoying certain foods or combinations of food. The correct idea is given after each of the myths. Good material for stimulating class discussion.

How Much Can Your Heart Stand?, Morton M. Hunt, *Cosmopolitan,* Feb. 1954, pp. 32–37.

Heart disease scares most people because it is the number one killer. Heart patients should continue their activities under the direction of a physician. The article tells you why and how it can be done.

When Not to Diet, Hilde Bruch, *Collier's,* Feb. 5, 1954, pp. 82–85.

Sensible people may diet to improve their physical condition. They should refuse to do so if the consequent loss of weight will not make them healthier and happier.

Satan of the North, Leonard A. Stevens, *Collier's,* Feb. 5, 1954, pp. 92–95.

A thrilling description of the capture and photographing of a wolverine. Some interesting facts about their habits are included.

I've Killed 5000 Rattlers, William T. Sweet, *Outdoor Life,* Feb. 1954, pp. 54–55 & 110–112.

Hunting the prairie rattlesnake for many years has given Mr. Sweet and his wife many thrills and many ideas about the habits of rattlers. The article stresses the constant vigilance which a hunter must exercise if he is to avoid being struck by one of them.

The Future of Your Farm, John Bird, *Country Gentleman,* Feb. 1954, pp. 29 & 71–76.

Some startling facts about population growth and the land available for raising our food supplies. For your more thoughtful students.

I Crashed in Suicide Seat, Mary Harrington Feldman, *Sat. Ev. Post,* Jan. 30, 1954, pp. 17–19 & 62–63.

Want to get a good idea of how you might feel if you lived after riding next to the driver when his car crashed? This vivid article should be read by all who drive.

The Coral Reef, Lincoln Barnett, *Life,* Feb. 8, 1954, pp. 74–94.

The eighth of the series "The World We Live In." Superb pictures of the corals and of many exotic animals which associate with them. Several copies of this article should be included in your permanent files. The text is more readable for your better students.

Such Interesting Snails, James Poling, *Collier's,* Feb. 19, 1954, pp. 106–109.

What might happen if we brought some strange snails into this country? This article describes some disastrous effects of such introductions in other countries and the concern we now must give to the giant African snail.

You Don't Have to Be Afraid of Operations, Fred W. Rankin, M.D., *Woman's Home Companion,* Feb. 1954, pp. 4–6 & 47 & 54–56.

Fear, which prevents many a needed operation, can be notably reduced by reading this article. What goes on in preparation for, during, and after the operation are so well explained that fear due to ignorance of medical procedures is dispelled. Worth reading by your better students.

Across The Editor's Desk

Decayed teeth may literally be made as good as new if discoveries announced at an American Chemical Society meeting are confirmed by further research. In the future, cavities may be repaired with materials that allow calcium and phosphate mineral crystals to grow into them, producing fillings indistinguishable from real teeth, Martin Burger, chemistry department of the Jewish Hospital of Brooklyn, told a scientific conference of the Society's New York Section.

The largest use of antibiotics outside the drug field is in animal feed supplements, and Dr. Louis L. Rusoff of the Louisiana State University re-

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ported to an American Chemical Society symposium evidence that such supplements accelerate animal growth by stimulating faster bone development.

Ancient Chinese herb cures now appear to have been scientifically sound, Dr. T. S. Ma, professor of chemistry in New York University, told the American Chemical Society's New York Section. Recent research has shown that certain herbs, used medicinally in the Orient for thousands of years, are definitely germ-killers. Citric, malic, and tartaric acids were some of the substances found to have anti-bacterial effects.

Begun in 1953, a program concerning the problems of high school–college articulation will be conducted at the University of Chicago from June 28 to July 30, and is open to college, junior college, and high school teachers. Demonstration sections of high school students in the biological sciences, English, French, German, humanities, physical sciences, mathematics, and social sciences, with seminars and lectures will be the methods largely used. Scholarships to the participants for full tuition are available, and graduate credit is available. Address inquiries to: Mr. Harold Dunkel, University of Chicago, Chicago 37, Illinois.

Copies of "Better Laboratory Planning," a guide for those planning new laboratories, may be obtained free from the Laboratory Equipment Section, Scientific Apparatus Makers Association, 20 No. Wacker Drive, Chicago 6, Illinois.

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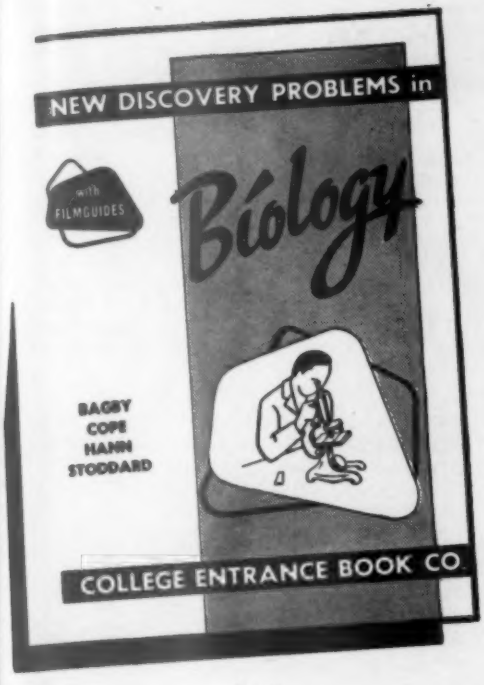
An excellent **Code of Ethics for Teacher Placement Officers** may be obtained by writing to: Dr. V. F. Dawald, Pres., Illinois Teacher Placement Assn., Milliken Univ., Decatur, Ill. This may interest many life science teachers, as well as placement officers.

Mrs. Agnes Meyer, wife of the chairman of the board of the Washington Post, proposes a National Commission of Scholars and Educators "to recast our educational system, encourage the gifted student, and formulate an intensive program for the discovery of talented children."

The award of the Nobel Prize for Physics of 1953 to Dr. Frits Zernike reminds us that Arthur T. Brice's Phase Films are the only audio-visual aid materials using the Zernike phase-contrast methods available to biology teachers. See the advertisement on page 78 for the details of phase-contrast films available.



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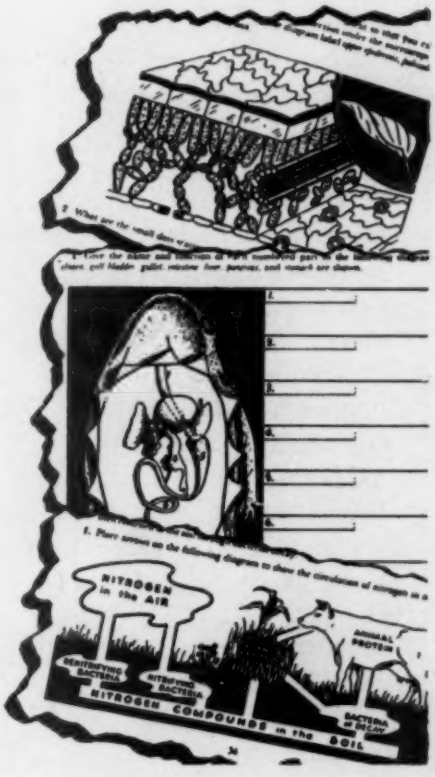

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